Sandia National Laboratories
Carlsbad Programs Group

Waste Isolation Pilot Plant

Technical Baseline Migration Analysis Plan

Task 1.3.5.1.2.1

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1. INTRODUCTION AND OBJECTIVES

The Department of Energy (DOE) Waste Isolation Pilot Plant (WIPP) Compliance Certification Application (CCA) performance assessment (PA) calculation was conducted in 1996 (DOE, 1996) as part of the overall compliance certification process established by the U.S. Environmental Protection Agency (EPA) in its radiation disposal standards, 40 CFR 191 (EPA, 1993), and compliance criteria, 40 CFR 194 (EPA, 1996). In 1997, the EPA mandated another full PA, referred to as the Performance Assessment Verification test (PAVT), that implemented a suite of changes in parameter values and distributions affecting about 30 of the approximately 1500 CCA parameters (EPA, 1998b,c,d). The result was two separate baselines against which output from future PA runs may be compared.

In support of the upcoming compliance recertification application (CRA) process, DOE proposes to merge the parameter databases from the CCA and PAVT, and thus create one technical baseline. Such a technical baseline migration (TBM) will involve a single performance assessment calculation that may be used as a baseline for future PA calculations, e.g. in performing impact assessments. This would result in a cost savings through reduced computational efforts due to the elimination of dual baselines, and furthermore facilitate EPA reviews during the CRA.

This report outlines a plan to migrate to a single technical baseline through a PA calculation scheduled to commence in February, 2002. Migration from the CCA to the new baseline will involve several changes to the Salado flow model, coupled with incorporation of the PAVT parameter database. This includes:

- Changes to Salado Flow Model
  - Elimination of the shaft system (also eliminates the need for more than 400 of the ~1500 CCA parameters)
  - Modifications to DRZ properties
  - Inclusion of Option D panel closure
  - Changes to grid geometry
  - Code revisions
- Incorporation of parameter values and distributions mandated by EPA in the PAVT
- Uncertainty and sensitivity analysis

2. APPROACH

2.1 Salado Flow Model

Several changes to the Salado unsaturated flow model will be implemented for the TBM. Major changes are highlighted here, with details given in Stein (2002).

2.1.1 Elimination of Shafts in the BRAGFLO Grid

The presence of shafts in the BRAGFLO grid negligibly impacts the results of PA calculations (Helton et al., 1998). Inclusion of the shafts in the PA requires approximately 400 parameters, which must all be tracked, adding an unnecessary aspect of complexity. It is therefore proposed to eliminate the shafts from the model. Removal of the shafts entails a change in the conceptual model, which must be validated by supporting documentation and subsequently submitted to peer review in order to be used for compliance calculations.

2.1.2 Modifications to DRZ properties

The Disturbed Rock Zone (DRZ) permeability will be represented as it was in the PAVT (EPA, 1998d) for repository pressure below a critical value. Above this critical pressure, a fracture model will be implemented in the DRZ below the repository in order to provide a fluid pathway to marker bed 139 in the event of high repository pressures.

2.1.3 Implementation of Option D panel closures

The 1996 CCA listed four design options for panel closures, and the EPA mandated (EPA, 1998a) that DOE use the design theorized to provide the least brine flow between waste panels, referred to as the Option D panel closure design. This design requires extension of the panel closure into the DRZ immediately above and below the seal. The geometry of the BRAGFLO grid and properties of the seal and DRZ adjacent to the seals will reflect implementation of this design for the TBM calculations.

2.1.4 Changes to grid geometry

Grid geometry for TBM will differ from the CCA and PAVT in four ways: (1) the shaft will be removed from the model domain, (2) the "rest of repository" will be changed from one grid block to two blocks separated by a panel closure, (3) a simplified algorithm will be employed for calculating regional flaring in grid blocks to the north and south of the excavated area, and (4) the grid will be refined above and below marker bed 139. See Stein (2002) for an illustration of the TBM BRAGFLO grid.

2.1.5 Code Revisions

BRAGFLO version 4.10 has been modified to change the molecular weight of cellulose (ERMS#231943, 1996; ERMS#232286, 1996), and the PARAMS.INC file has been modified to accommodate the increased number of grid blocks. The code has also been regression-tested to work on the Compaq ALPHA ES40 platform.

2.2 Incorporation of PAVT Parameters

As part of the compliance requirements outlined in 40 CFR 194, the EPA conducted a thorough technical review of the parameters used in the WIPP CCA PA. These efforts were documented

in a series of three reports in which parameters were examined for adequate documentation and technical rationale (EPA, 1998b), PA model outputs were investigated for sensitivity to input parameter changes (EPA, 1998c), and the disposition of so-called inadequately supported parameters was described (EPA, 1998d). Parameters identified in the third report (EPA, 1998d) that were still at issue were ultimately incorporated in the PAVT. Since only about 30 of the original ~1500 CCA parameters were challenged by the EPA in the aforementioned technical review, the new TBM parameter data set will look primarily like the CCA, but with PAVT values used for the disputed parameters. In addition, several changes to Disturbed Rock Zone (DRZ) and Panel Closure System (PCS) properties will be implemented as detailed in Stein (2002). The specific input parameter set to used for the TBM will be fully documented and tabulated in a forthcoming revision of the Technical Baseline Migration Parameter Report (Wall, 2001).

2.3 Uncertainty and Sensitivity Analysis

A thorough uncertainty and sensitivity analysis will be conducted as part of the TBM. Details of this analysis will be outlined in a forthcoming analysis plan.

3. SOFTWARE LIST

The codes that will be used in the TBM calculation are summarized in Table I.

Table I. Codes to be Used in the TBM Calculation

Code	Version
ALGEBRACDB	2.35
BRAGFLO	4.10.02
GENMESH	6.08
ICSET	2.22
LHS	2.41
MATSET	9.04
POSTBRAG	4.00
POSTLHS	4.07
PREBRAG	6.00
PRELHS	2.24

4. TASKS

Cliff Hansen and David Chace will provide overall project coordination and management. Specific tasks and responsible individuals are listed below in Table II.

Table II. Schedule of Tasks for the TBM Calculation

Date	**Task(s)**	**Responsible Individual**
January 28 – February 11, 2002	Prepare Inputs	Joshua Stein David Lord
February 11 – February 25, 2002	BRAGFLO Calculations	Joshua Stein Rodger Coman
February 25 - March 25, 2002	Analysis of results	Joshua Stein Teklu Hadgu David Lord Kari Cox Jennifer Long Jon Helton James Garner

5. SPECIAL CONSIDERATIONS

No special considerations have been identified for this analysis..

6. APPLICABLE PROCEDURES

Analyses will be conducted in accordance with the quality assurance (QA) procedures listed below.

Training: Training will be performed in accordance with the requirements of NP-2-1, Qualification and Training.

Parameter Development and Database Management: Creation and documentation of parameter values will follow NP 9-2. The database is to be managed in accordance with relevant technical procedure.

Computer Codes: Computer codes used in the analysis will be qualified in accordance with NP19-1. The platform on which codes will be run is the Compaq Alpha., Open VMS AXP, version 7.2.

Analysis and Documentation: Documentation will meet the applicable requirements in NP9-1 and NP17-1.

Reviews: Reviews will be conducted and documented in accordance with NP6-1 and NP9-1, as appropriate.

7. REFERENCES

DOE, 1996. *Title 40 CFR Part 191 Compliance Certification Application for the Waste Isolation Pilot Plant*. DOE/CAO-1996-2184. DOE Carlsbad Area Office, Carlsbad, NM.

EPA, 1993. *40 CFR Part 191: Environmental Radiation Protection Standards for the Management and Disposal of Spent Nuclear Fuel, and High-Level Transuranic Wastes. Final Rule.* Federal Register, vol. 48, no. 242. p. 66398-416. December 20, 1993. Office of Radiation and Indoor Air, Washington, DC.

EPA, 1996. *40 CFR Part 194: Criteria for the Certification and Re-Certification of the Waste Isolation Pilot Plant's Compliance with the 40 CFR Part 191 Disposal Regulations. Final Rule*. Federal Register, vol. 61, no. 28. p. 5224-45. February 9, 1996. Office of Radiation and Indoor Air, Washington, DC.

EPA, 1998a. *40 CFR Part 194: Criteria for the Certification and Recertification of the Waste Isolation Pilot Plant's Compliance with the Disposal Regulations: Certification Decision; Final Rule.* Federal Register, vol. 63, no. 95. p. 27353-406. May 18, 1998. Office of Radiation and Indoor Air, Washington, DC.

EPA, 1998b. *Technical Support Document for Section 194.23: Parameter Report*, Docket No.: A-93-02, Item V-B-12, U.S. Environmental Protection Agency, Office of Radiation and Indoor Air, Washington D.C.

EPA, 1998c. *Technical Support Document for Section 194.23: Sensitivity Analysis Report,* Docket No.: A-93-02, Item V-B-13, U.S. Environmental Protection Agency, Office of Radiation and Indoor Air, Washington D.C.

EPA, 1998d. *Technical Support Document for Section 194.23: Parameter Justification Report*, Docket No.: A-93-02, Item V-B-14, U.S. Environmental Protection Agency, Office of Radiation and Indoor Air, Washington D.C.

ERMS# 231943, *Estimates of Gas-Generation Parameters for the Long-Term WIPP Performance Assessment*, Sandia National Laboratories, memo by Y. Wang, and L. Brush, January 26, 1996.

ERMS# 232286, *Modify the Stoichiometric Factor y in BRAGFLO to include the Effect of MgO Added to WIPP Repository as a Backfill*, Sandia National Laboratories, memo by Y. Wang, and L. Brush, February 23, 1996.

Helton, J.C., Bean, J.E., Berglund, J.W., Davis, F.J., Economy, K., Garner, J.W., Johnson, J.D., MacKinnon, R.J., Miller, J., O'Brien, D.G., Ramsey, J.L., Schreiber, J.D., Shinta, A., Smith, L.N., Stoelzel, D.M., Stockman, C., Vaughn, P., 1998, *Uncertainty and Sensitivity Analysis Results Obtained in the 1996 Performance Assessment for the Waste Isolation Pilot Plant*, Sandia Report: SAND98-0365, Sandia National Laboratories, Albuquerque, NM.

Stein, J.S., 2002, *Analysis Plan for Calculation of Salado Flow: Technical Baseline Migration (TBM)*, Sandia National Laboratories, AP-086.

Wall, 2001. *Technical Baseline Migration Parameter Report, Revision 0*, Sandia National Laboratories, Carlsbad Programs Office, ERMS# 519513. .